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Enabling world-scale advanced circular recycling of plastics with ISCC PLUS

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Enhancing the quality of life in a **material way**

EASTMAN
CELEBRATING 100 YEARS
1920 – 2020

Plastics improve the quality of life . . .

HYDRATE

2.2B people globally still do not have access to clean drinking water.

FEED

Advanced packaging technologies can prevent 72k tons of landfilled food, preventing 329k tons GHG emissions annually in the U.S.*

CARE

Plastics improve sterility, patient safety, and comfort in therapies.

. . . BUT what about end of life?

*Source: refed.com

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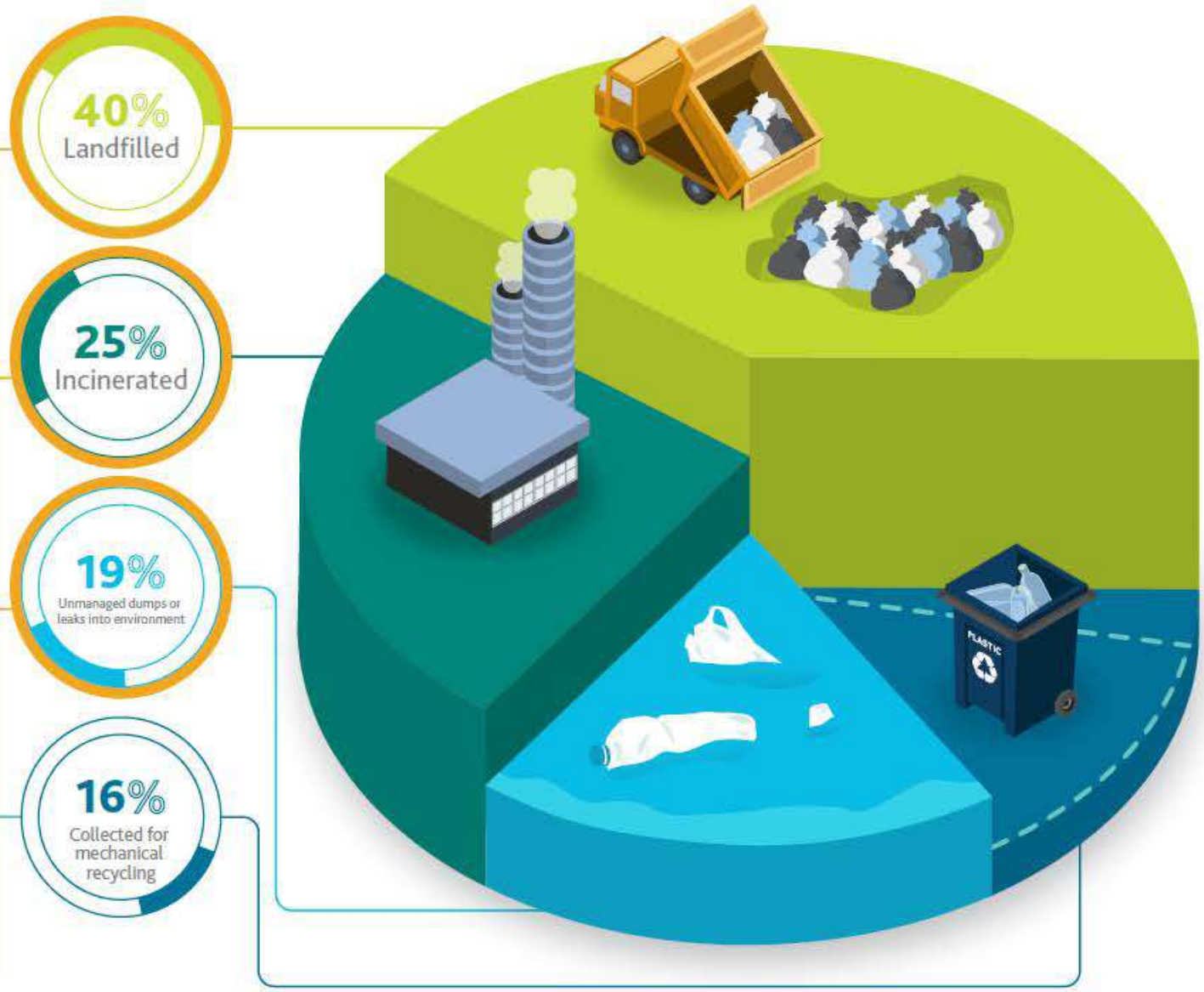
The world has a plastic waste problem.

Opportunities **going to waste**

300 million metric tons
of plastics are produced globally

260 million metric tons
of plastics are disposed

Eastman Advanced Circular Recycling technologies are applicable to these types of waste



SOURCE: www.mckinsey.com/industries/chemicals/our-insights/how-plastics-waste-recycling-could-transform-the-chemical-industry

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ELLEN MACARTHUR FOUNDATION

"Inspiring a generation to rethink, redesign, and build a positive future through the framework of a circular economy"

CE100

MAKE FASHION CIRCULAR

NEW PLASTICS ECONOMY

Global Commitment

THE PLASTICS PACT

GLOBAL PARTNERS OF THE ELLEN MACARTHUR FOUNDATION

BlackRock · DANONE · DS Smith · Google · H&M Group · INTESA SANPAOLO · PHILIPS · RENAULT · SC Johnson · SOLVAY · Unilever

Committed to at least

25% recycled content by 2025

These commitments are impossible with mechanical recycling alone.

Chemical recycling with certified mass balance is a critical enabler.

ISCC International Sustainability & Carbon Certification

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Mechanical recycling is not enough to solve the plastic waste problem.

	Common uses	Share of plastic waste generated	Mechanically recycled?
1 PETE Polyethylene terephthalate	Bottles	14%	**Yes (clear) ~ 30% recycle rate**
	Films, forms, other		✗
	Textiles	N/A	**Very little**
	Carpet	N/A	**Very little**
2 HDPE High-density polyethylene		17%	**Yes ~ 9% recycle rate (natural HDPE ~ 31%)**
3 PVC Polyvinyl chloride		3%	✗
4 LDPE Low-density polyethylene		23%	**Very little**
5 PP Polypropylene		23%	**Very little**
6 PS Polystyrene		7%	✗
7 OTHER Other (acrylic, polycarbonate, PETG, mixed plastics)		13%	**Very little** *Diversity of materials risks contamination.*

Most mechanical recycling results in **downcycling** into lower-value products that eventually are landfilled.

Generated share and recycled share of material sent to U.S. Municipal Solid Waste in 2017 reported as recycled by U.S. EPA. "Combusted" materials not considered recycled. Total of 32,120,000 MT discarded. Recyclability from OurWorldinData.org.

MECHANICAL RECYCLING vs. AND CHEMICAL RECYCLING

- Optimal GHG footprint
- Limited to clean sources
- Degradation in performance properties
- Finite processing

Best choice if applications allow

- Improved GHG footprint
- Enable use of broad range of waste
- Indistinguishable performance
- Infinite processing

Required where mechanical cannot work

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A material
REVOLUTION
in the making

Vision for a sustainable future

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Transforming our product portfolio to participate in the circular economy via **three loops**

Eastman's Advanced Circular Recycling technologies

ISCC International Sustainability & Carbon Certification

Mechanical recycle stream technology

Operational today

Carbon renewal technology

REFORMING

Operational today

Polyester renewal technology

GLYCOLYSIS

Operational today

METHANOLYSIS

Operational by 2022

EASTMAN ADVANCED CIRCULAR RECYCLING TECHNOLOGIES

Carbon renewal technology (CRT)

1 PETE 2 HDPE 4 LDPE
5 PP 6 PS 7 OTHER

MIXED PLASTIC WASTE

REFORMING (NOW)

MOLECULES

C, O, H_2
(syngas)

Cellulosic plastics
(20%–100% recycled content allocated by mass balance)

20%–50% LOWER GHG
(intermediates)

Polyester renewal technology (PRT)

1 PETE

PET PLASTIC WASTE

GLYCOLYSIS (NOW)

METHANOLYSIS (2022)

MONOMERS

Recycled DMT, recycled EG

Copolyester specialty plastics

20%–30% LOWER GHG
(intermediates)

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Eastman Advanced Circular Recycling technologies

Carbon renewal and polyester renewal can process up to

23 million

kilograms of waste. Right. Now.

ISCC International Sustainability & Carbon Certification

3 processing sites certified under ISCC PLUS

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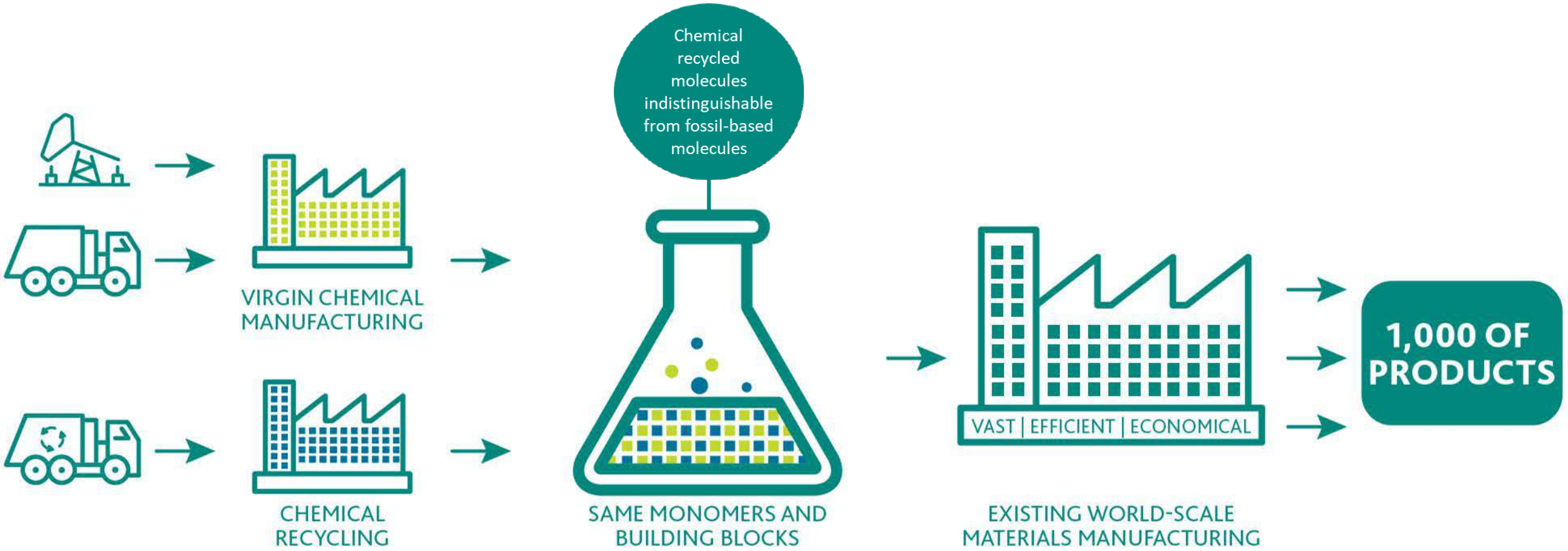
Mechanical recycling is not enough to solve the plastic waste problem.

Plastic type	Common uses	Share of plastic waste generated	Mechanical recycling?	Eastman Advanced Circular Recycling?	
				PRT	CRT
1 PETE Polyethylene terephthalate	Bottles	14%	Yes (clear) ~ 30% recycle rate	✓	✓
	Films, forms, other		✗	✓	✓
	Textiles	N/A	Very little	✓	✓
	Carpet	N/A	Very little	✓	✓
2 HDPE High-density polyethylene		17%	Yes ~ 9% recycle rate (natural HDPE ~ 31%)	✗	✓
3 PVC Polyvinyl chloride		3%	✗	✗	Not yet (2nd generation)
4 LDPE Low density polyethylene		23%	Very little	✗	✓
5 PP Polypropylene		23%	Very little	✗	✓
6 PS Polystyrene		7%	✗	✗	✓
7 OTHER Other (acrylic, nylon, polyurethane, polycarbonate, PETG)		13%	Very little *Diversity of materials risks contamination.*	✗	✓

Generated share and recycled share of material sent to U.S. Municipal Solid Waste in 2017 reported as recycled by U.S. EPA. “Combusted” materials not considered recycled. Total of 32,120,000 MT discarded. Recyclability from OurWorldinData.org.

MASS BALANCE ENABLES CHEMICAL REYCLING AT WORLD-SCALE



Mass balance

- Is an accounting system that enables chemical recycling to happen at massive *scale*
- Tracks recycle materials co-processed together with virgin in *existing* assets
- Guarantees the recycle content allocated to products balances with inputs
- Enables linkage of recycle capability to market demand

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Link to whitepaper on mass balance

Eastman view on ISCC PLUS challenges for circular economy

- Standardized claims for percent recycled content based on mass balance allocation
- Mass balance methodology to accommodate more complex products, operations, and ERP systems
- Licensing option needed for brand owners
- Regional credit transfer needs for processing & storage
- Streamlined certification structures for complex value chains

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ISCC PLUS is the front-runner and has tremendous opportunity for global adoption as “the” certification for advanced plastic recycling.